

Claims

1. Electromagnetic linear motor of the traveling field type, with a magnetic coil arrangement (4) and a permanent magnet (3) linearly movable relative to said magnetic coil arrangement (4), the magnetic coil arrangement (4) comprising at least three magnetic coils (4a, 4b, 4c) configured and disposed to generate a traveling wave magnetic field for moving the permanent magnet (3) with positional precision, the magnetic coils (4a, 4b, 4c) comprising closed windings of conductive wire around a longitudinally extended cavity and the permanent magnet (3) being axially polarized and guided longitudinally displaceably inside the cavity, characterized by a sliding sleeve (2) guided axially displaceably inside the outer sheath (1) and enclosing an interior space in which the permanent magnet (3) is disposed, wherein an outer surface of the sliding sleeve (2) and at least one portion of the inner wall surface of the outer sheath form sliding surfaces that co-operate as a sliding bearing.
2. Electromagnetic linear motor according to claim 1, characterized in that the sliding surfaces of the sliding sleeve (2) or the outer sheath (3) or both are covered with layers of hard material such as Si_3N_4 , SiC or DLC (diamond-like carbon) in order to reduce friction and wear.
3. Electromagnetic linear motor according to claim 1 or 2, characterized in that soft magnetic armature pole pieces (5) are mounted on the permanent magnets (3) to guide the magnetic flux.
4. Linear motor according to claim 3, characterized in that the soft magnetic armature pole pieces (5) are disposed at the two far ends of the permanent magnet (3).
5. Linear motor according to claim 1, characterized by a non-ferromagnetic outer sheath (1) which encloses the cavity and around which the windings of conductive wire are wound.
6. Linear motor according to one of claims 1 to 5, characterized by a soft magnetic outer tube (6) enclosing the magnetic coil arrangement (4).
7. Electromagnetic linear motor according to one of claims 1 to 6, characterized in that the axially magnetized permanent magnet (3) is of any geometric shape with an axial bore for an optical beam path.
8. Electromagnetic linear motor according to one of claims 1 to 7, characterized in that the axially magnetized permanent magnet (3) is annular in shape.

9. Electromagnetic linear motor according to one of claims 1 to 8, characterized in that soft magnetic stator pole pieces (8) are mounted between the separate coils (4) to increase the resultant axial force.
10. Electromagnetic linear motor according to one of claims 1 to 9, characterized in that a plurality of armatures (11) of identical design are disposed in a common outer sheath (1) and can be individually moved by separately supplying current to different axially offset groups of triple coils.
11. Electromagnetic linear motor according to claim 10, characterized in that the paths of travel of the different armatures (11) are superimposed by reversing the current supplied to the coils.
12. Electromagnetic linear motor for moving optical elements inside an outer sheath (1), characterized in that the motor has an axially movable sliding sleeve (2) that is guided slidably inside an outer sheath (1) and forms an armature (11) with at least one axially polarized permanent magnet (3) disposed inside the sliding sleeve, the motor also having an arrangement of at least three coils (4) that are wound around the outer sheath (1) and by being supplied independently and variably with current can generate a magnetic field that is concentrically guided and intensified by magnetic reflux via the soft magnetic outer tube (6) and the soft magnetic armature pole pieces (5), the three-phase traveling field producing the axial movement of the permanent magnet (3) and hence of the sliding sleeve (2), and by interaction with the permanent magnet (3) generates self-holding forces that lead to the location of the armature being fixed and to the position of the optical elements (7) being stabilized by restoring forces.
13. Electromagnetic linear motor according to claim 12, characterized by additional groups of triple coils (4a,b,c) being arranged in sequence on the outer sheath (1) such that the path of travel of the armature (11) is extended without the axial length of the armature (11) having to be modified.
14. Electromagnetic linear motor according to claim 12, characterized in that the armature consists of a plurality of segments of axially magnetized permanent magnets each with a polarity that is opposite that of the adjacent magnet.
15. Electromagnetic linear motor according to one of claims 12 to 14, characterized by at least one optical element being mounted on the armature (11).
16. Electromagnetic linear motor according to claim 16, characterized in that the optical element is disposed inside the sliding sleeve (2).
17. Electromagnetic linear motor according to one of claims 1 to 16, characterized in that the linear motor is designed for exposure to a temperature of at least

133°C for several hours for sterilization purposes, without detriment to its operation.